

Simulations of the Box Cavity MTA Experiment

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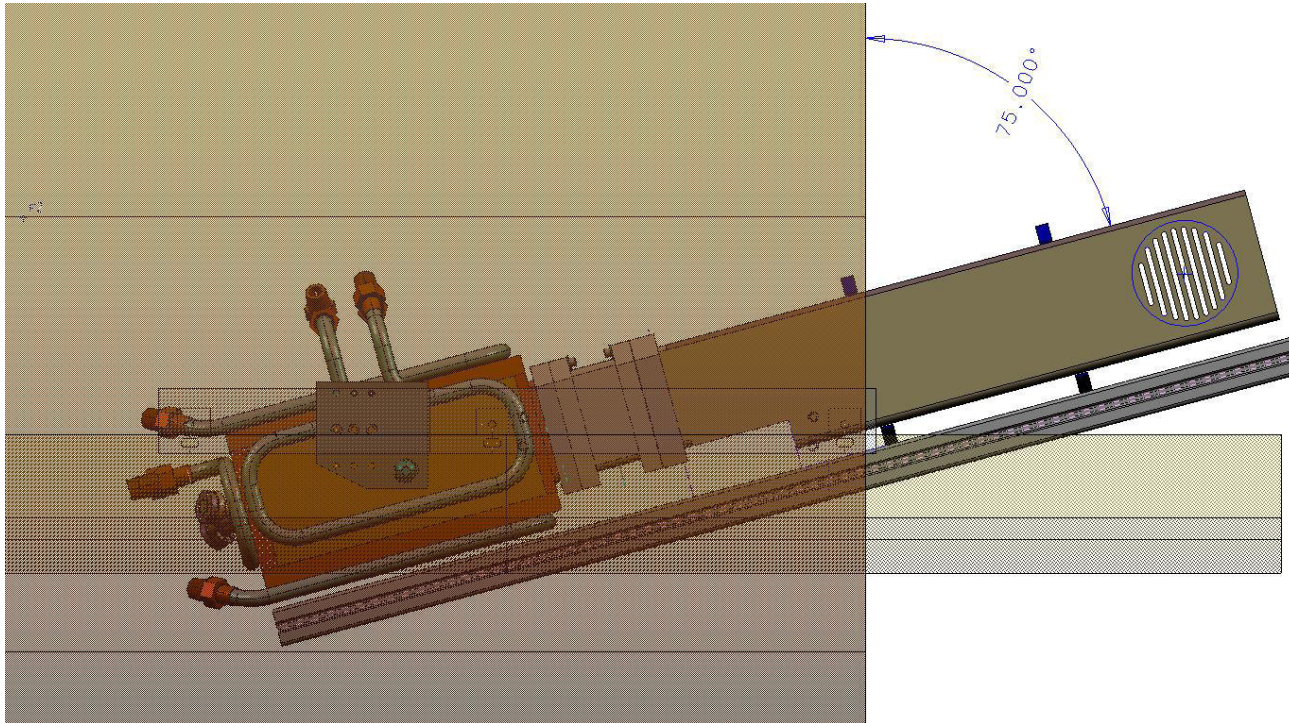
Advanced Accelerator Group
Brookhaven National Laboratory

NFMCC Friday Meeting
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Outline

- Review of MTA Box Cavity Experiment
- Concept of Magnetic Insulation
- Simulation Details and Results
- Discussion
- Conclusion and Outlook

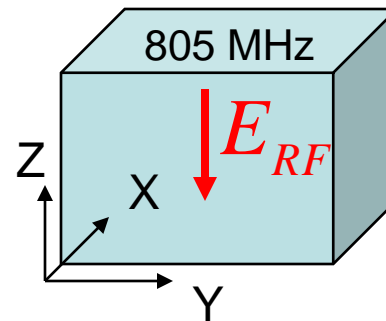
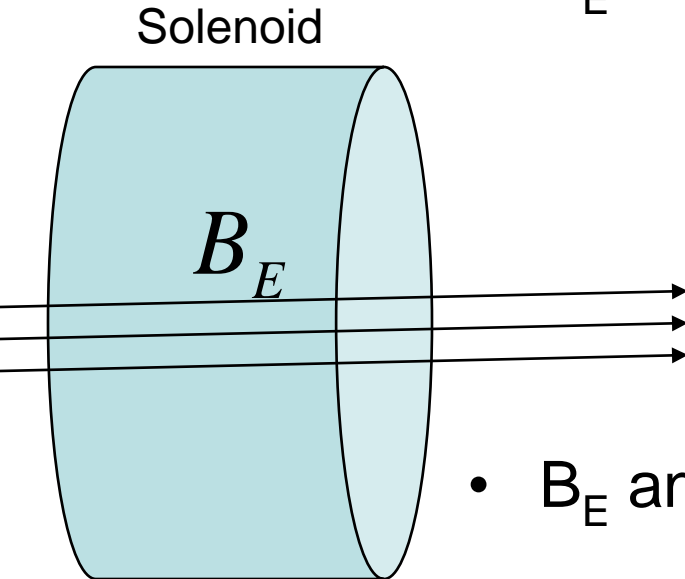
MTA Box Cavity Experiment



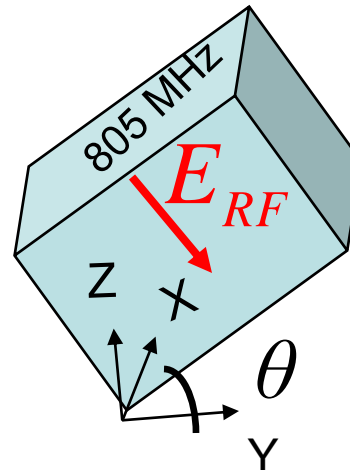
- See talks of Moretti NFMCC Meeting in LBNL (2009) but also NFMCC Phone Meeting (02/13/09).

Magnetic Insulation Concept

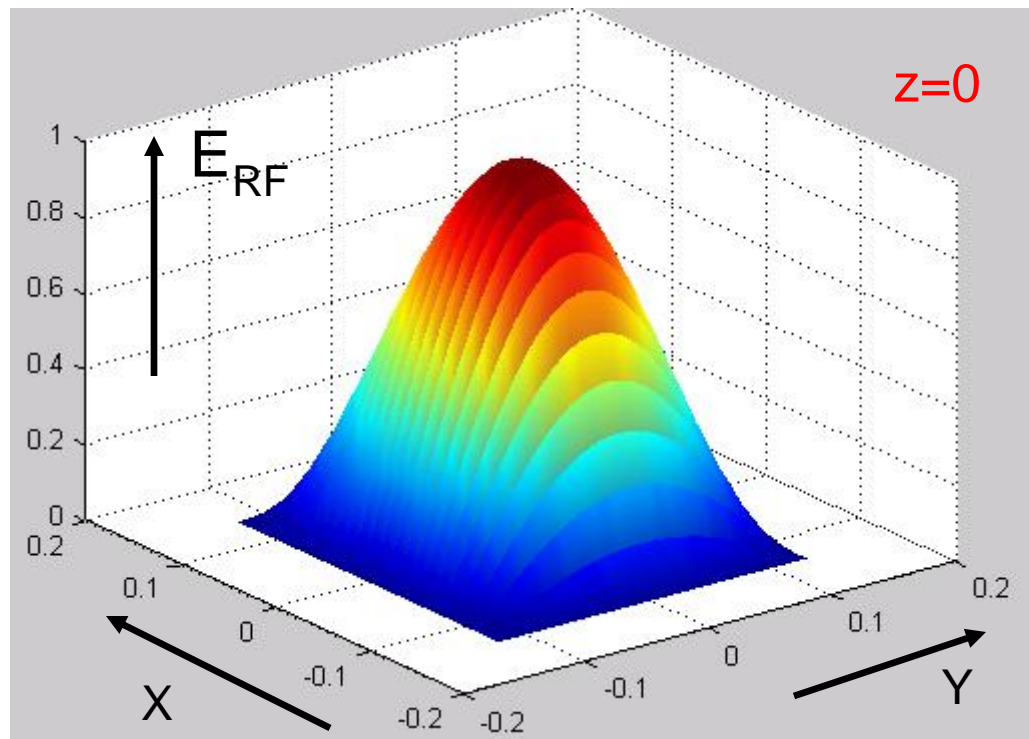
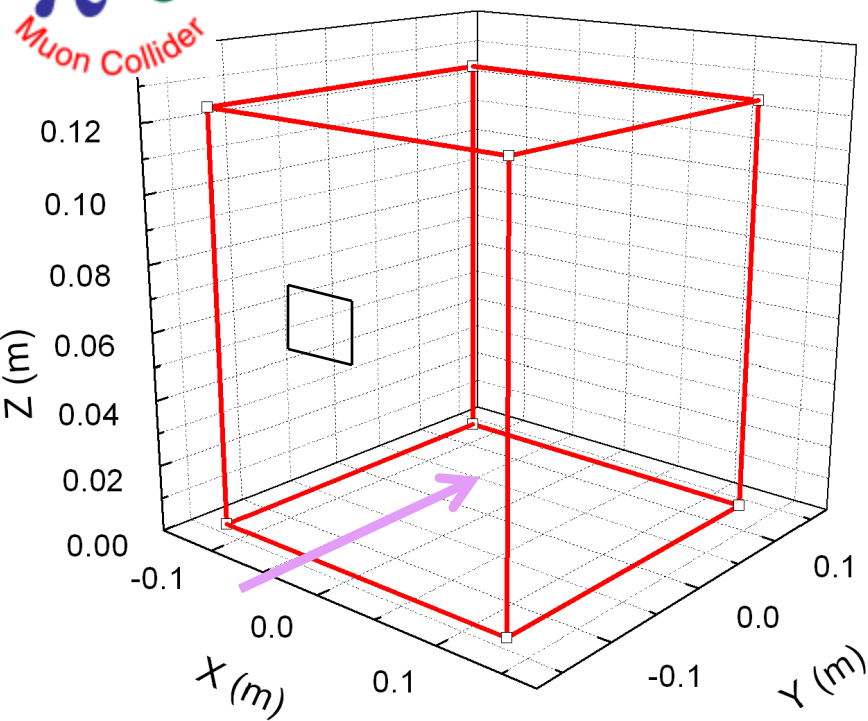
- B_E and E_{RF} are at 90 degrees (**good** insulation)



- B_E and E_{RF} are at < 90 degrees (**poor** insulation)



MTA Box Cavity RF Fields



$$\alpha = 250 \text{ mm}$$

$$b = 276.497 \text{ mm}$$

$$d = 123.825 \text{ mm}$$

$$E_x = E_y = 0$$

$$E_z = E_0 \cos\left(\frac{\pi x}{a}\right) \cos\left(\frac{\pi y}{b}\right) \cos(\omega t)$$

$$B_x = -\frac{\pi E_0}{b\omega} \cos\left(\frac{\pi x}{a}\right) \sin\left(\frac{\pi y}{b}\right) \sin(\omega t)$$

$$B_y = \frac{\pi E_0}{a\omega} \sin\left(\frac{\pi x}{a}\right) \cos\left(\frac{\pi y}{b}\right) \sin(\omega t)$$

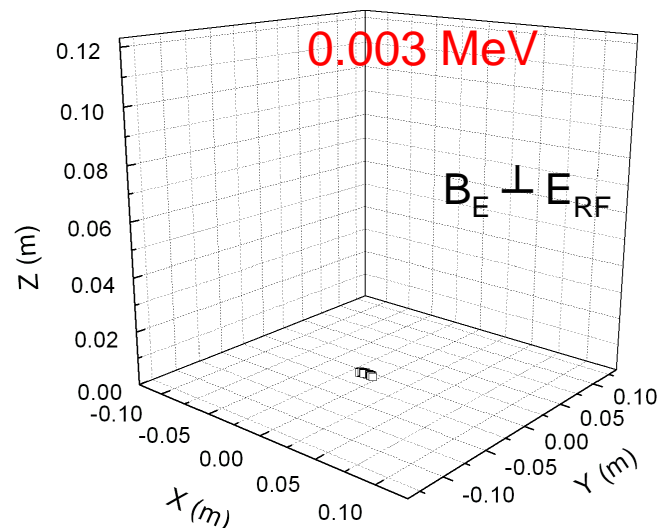
$$B_z = 0$$

$$\omega_{110} = \pi c \sqrt{\left(\frac{1}{a}\right)^2 + \left(\frac{1}{b}\right)^2}$$

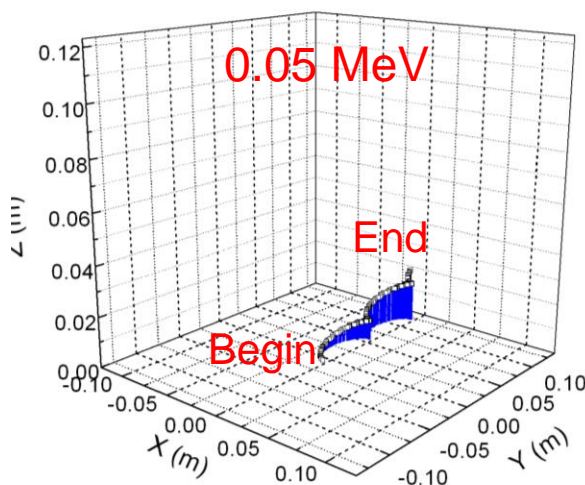
Particle Trajectories

- Particle tracking with CAVEL v. 1.23

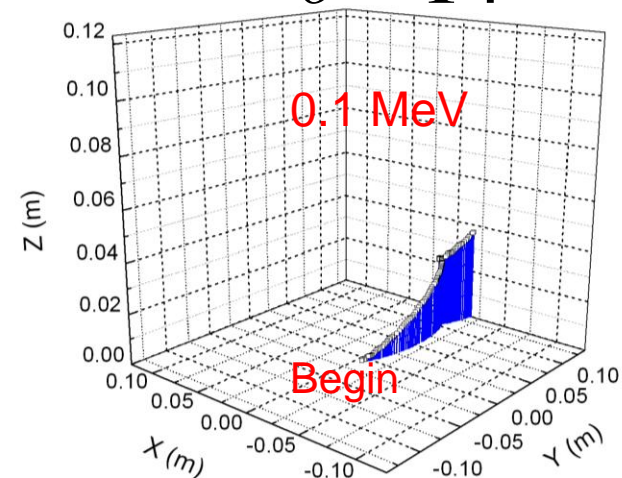
$$\theta = 0^0$$



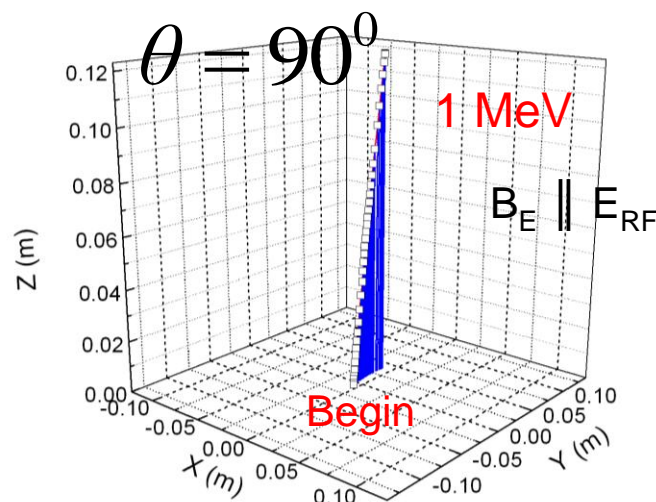
$$\theta = 7^0$$



$$\theta = 14^0$$



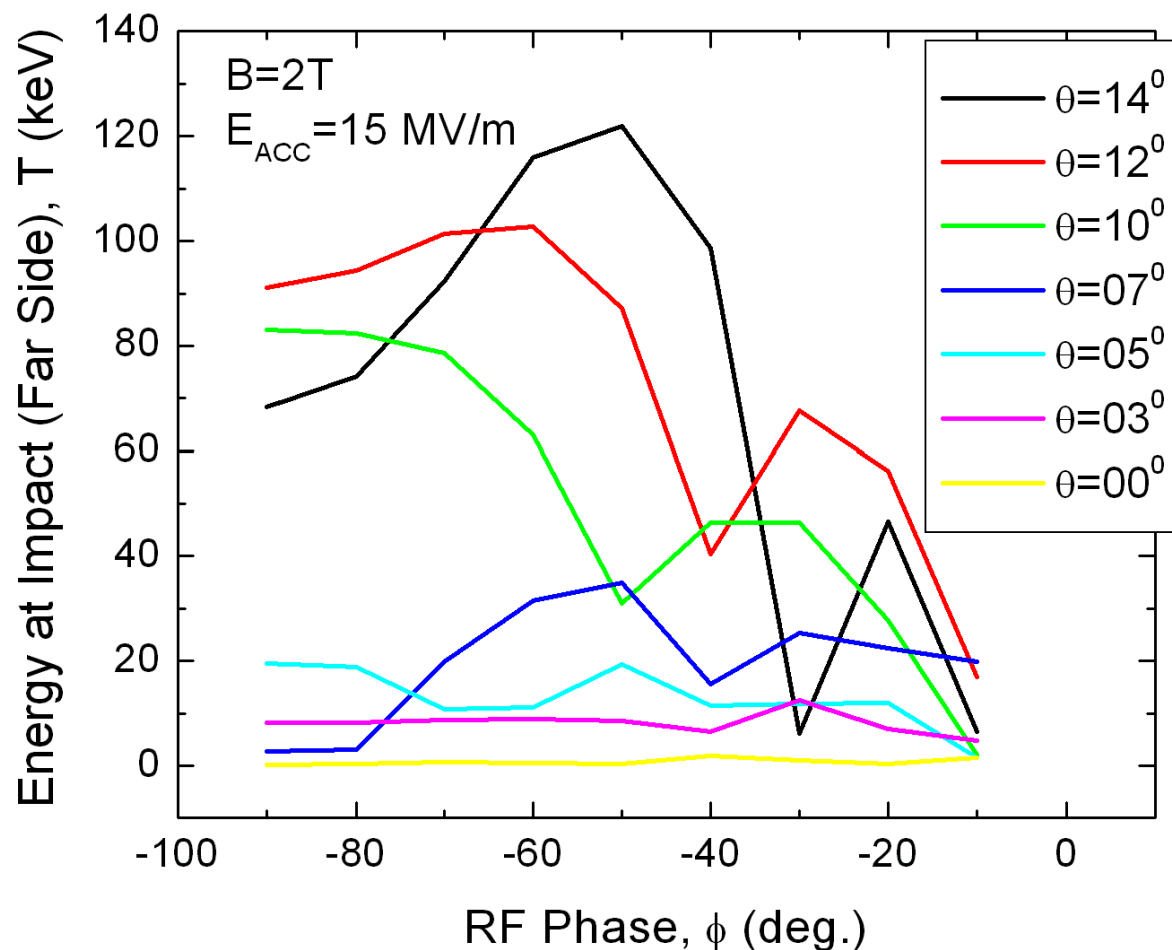
$$\theta = 90^0$$



θ is the departure angle from the $B \perp E$ condition

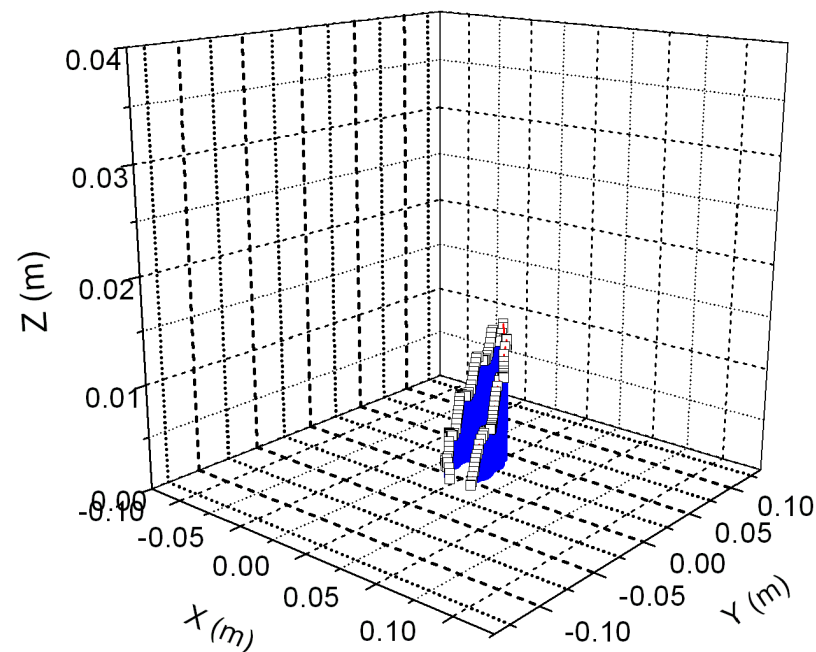
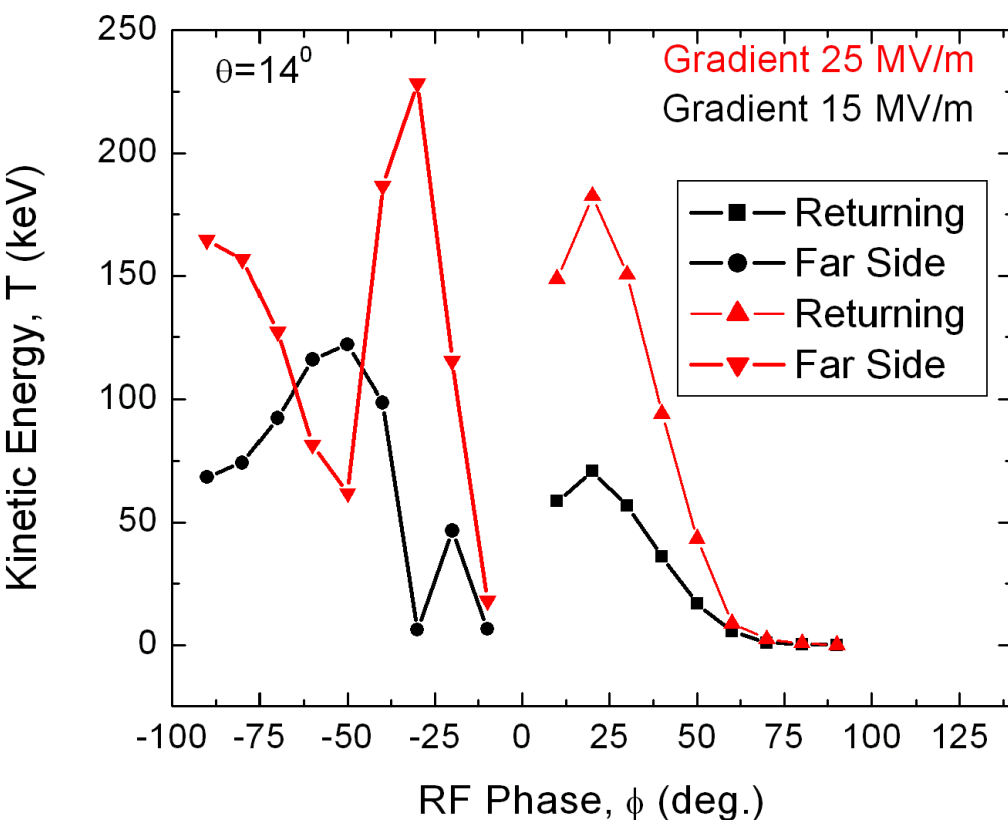
Energies at Impact Point

- θ is the departure angle from the $B \perp E$ condition
- So higher θ means worse insulation



Returning Particles

- I assume that $\theta = 14^\circ$
- Returning particles may cause also damage
- Still however the impact energy is less than 1 MeV



Summary/ Outlook

- Simulated the square cavity experiment
- A rotation of 10-14 may be fine to test the concept
- It will be interesting to look at the secondary electrons
- It will be also Interesting to input the actual field map from the MTA solenoid into the code.
- Use "real asperities" as initial distribution.